

Compatibilization of Immiscible Polymer Blends with Clay

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Introduction: The morphology of multi-component polymer blends is generally unstable and the different polymer components will phase separate and create large agglomeration of like-phases. Stabilization of polymer blends usually requires the addition of another component, which is often an expensive emulsifying agent such as a block copolymer. This component will ideally localize to the polymer-polymer interface and reduce the interfacial tension, thus stabilizing the morphology by reducing the driving force for phase separation. Recent studies have shown the emulsifying benefits of less expensive clay additives in oil-water mixture [1], but the effect on stabilizing polymer blends is not entirely understood.

Methods and Materials: We are examining the effect of functionalized clay additives on ternary polymer thin film blends. Films composed of 33:33:33 weight-% of polystyrene (PS), poly(methyl methacrylate) (PMMA) and poly(ethyl propylene) (PEP) ($M_w=90K$, $60K$, $20K$ respectively) were spun cast from toluene onto Si_3N_4 membranes. Identical films were prepared both with and without clay. All films were annealed in a vacuum oven at $170^\circ C$ for various times, quenched to room temperature and then transfer to the Stony Brook Scanning Transmission X-ray Microscope (STXM) at X1A for characterization.

Results: Figure 1 shows the evolution of the Polystyrene (PS) phase (the PS appears dark) in sample with and without clay. In these images and the corresponding images that map the PMMA and PEP, we observe generally smaller domains for the samples that contain clay.

Conclusions: We can thus infer that clay is a compatibilizer for polymeric systems.

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References: [1] U. Neuhausler, U. Abend, C. Jacobsen and G. Lagaly, "Soft X-ray spectromicroscopy on solid-stabilized emulsion", *Colloid Polym. Sci.*, **277**, 719, 1999

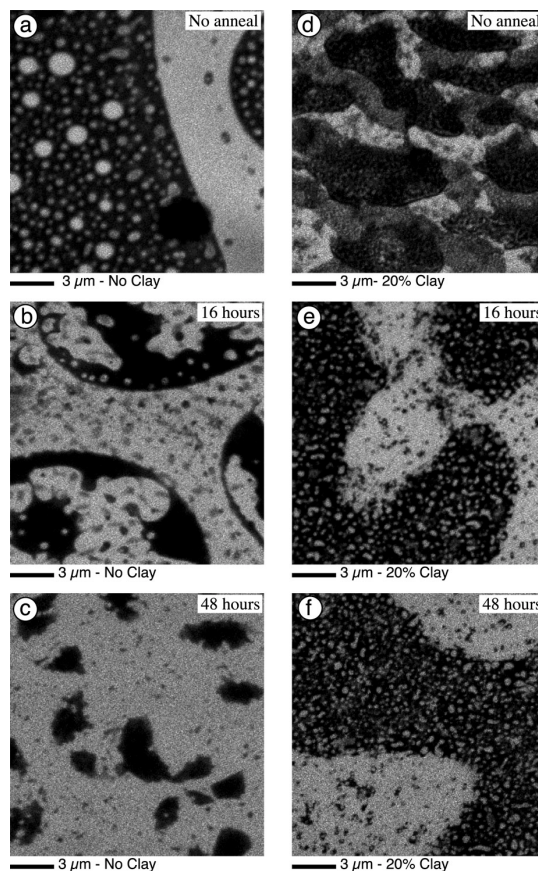


Figure 1. PS map. a) and d) was no annealed, b) and e) was annealed 16h, and c) and f) was annealed 48h.